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Policy Forums

The Red Queen race in Brazilian Amazon deforestation: the necessity of a sustainable economy to zero deforestation

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On June 30th, 2015, one of the most accessed news websites from Brazil had two highlighted headlines, which seemed contradictory, considering the dynamics of natural resources exploitation in Brazil. At a meeting with the USA President, the Brazilian President, Dilma Rousseff, proposed zero deforestation in Brazilian Amazon until 2030, while an agreement to sale *i natura* meat from Brazilian slaughterhouses to the USA markets had been signed by herself. In the last decade, Brazil reduced 80% of all deforestation in its Amazon (from 29,000 km^2 to 5000 km^2); therefore, it seems a tangible goal to eliminate all illegal deforestations in 15-year terms. However, in the last 30 years, the Brazilian Amazon economic behavior does not indicate a positive result for Rousseff's proposition to reduce deforestation, which will be one of Brazil's commitment at COP21 – United Nations Conference on Climate Change in Paris, France.

The history of deforestation combat in Amazon can be described by an analogy with Red Queen's race: economic changes precedes reactive actions by state, which try to revert current deforestation rates to those rates from previous period of the economic changes. The rupture of this paradigm depends on long-term actions, preceding the effects from social-economic changes, such as deforestation. To understand and evaluate the Brazilian government proposal, for zero illegal deforestation, it must start primarily with an analysis, even as synthetic, from occupation history in this system. Then, we will present the aspects of actions for deforestation control in the last 10 years and, with this, will evaluate better the future of a zero deforestation proposal.

In the Amazon region, 3500 years ago, records of agriculture and forest management by pre-Columbian communities were found (Clement and Junqueira, 2010). In recent years, 400 years ago, in high Xingu River there were complex societies, with settlements up to 8000 inhabitants (Heckenberger et al., 2003; Willis et al., 2004). Both communities, with ancient technologies, had caused tiny environmental changes to attempt their needs, but these changes did not prosper or promote little loss of natural vegetation.

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In the 20th century, before the Capital of Brazil was moved from coast to the interior, during the 1960s, the damages to the forest were a little and limited to the riparian regions of big rivers. The creation of a new Capital, Brasília, and the road building policy, which intended to link the entire country, supported an economic growth and a flux of people to the countryside, never seen before (Moran, 1993; London and Kelly, 2007).

During last century's 1970s and 1980s, governmental investments and colonization in the Brazilian Amazon brought conditions for exploitation that are more commodified, such as forest resources and the agriculture products from rural properties. The new infrastructure investments decreased the logistics costs and raised the profits in agriculture, livestock, wood exploration and others activities (Margulis, 2003; Fearnside, 2010). In the beginning, the cattle were consolidated as the main product for supplying domestic market. Afterwards, with the fall of commercial and sanity barriers, it supplied the international market (Margulis, 2003).

In smaller proportion, there had been surging of soybeans fields, supplying the international market, making the Amazon economy oscillate with the international price of these products. With the globalization of Amazon economy, in moments of higher price to cattle and soybean, the landowners increase production area by deforestation, given the low price of land in Amazon (London and Kelly, 2007; Margulis, 2003). This dynamic linked the deforestation rates with Brazilian GDP (gross domestic product) that causes two of the highest deforestation peaks of 29,059 km^2 in 1995 and 27,772 km^2 in 2004 (INPE, 2015).

Therefore, in 2004, a prevention and control of deforestation action plan in Brazilian Amazon (PPCDAM) was created. For the first time, a deforestation combat plan was considered at the highest level of public policies in federal government, with participation of several ministries such as ministries of environmental, science and technologies, agricultural, mines and energy and others (IPEA, 2011).

Between 2004 and 2012, the deforestation in Brazilian Amazon decreased from 27,772 km^2 to 4656 km^2. It is a consensus that the fall of deforestation rates has a direct connection with actions from PPCDAM (IPEA, 2011). Almost 52% of this deforestation rate fall is due to actions of PPCDAM (Assunção et al., 2012), among which we highlight:

- The creation of 50 million hectares of protected areas and broader definition of indigenous land.
- Environmental and economic zonation for the entire Brazilian Amazon.
- Creation of a system of satellite monitoring in real time (DETER), simultaneously with the previous system, PRODES; both systems are considered the best monitoring systems of land use changes in tropical forests (Kintisch, 2007; Nature, 2015).
- Termination of loans from governmental banks to landowners that has illegal deforestation areas in their properties, recognized by a public blacklist in Internet (naming and Shaming).
- Creation of an environmental rural register.
- Creation of Brazilian Forest Service and concession of 49,000 ha of sustainable forest management to private sector.

From 2004 to 2010, it was estimated that PPCDAM actions avoided the emission between 270 and 621 millions of CO_2 tons to atmosphere by deforestation, equivalent value of 3.1 billions of dollars in carbon credits (Assunção et al., 2012). This is the biggest contribution of just one country against climatic change (UN Climate Summit, 2014). Results like these allowed in COP 2009, in such a way that the Brazil was voluntarily committed to reduce in 80% the deforestation, in contrast to deforestation rates in 1994 and 2005. This reduction accomplishes 77%, if to consider the last rate in 2014.

The PPCDAM has three thematic axes: tenure land, command and control actions and the creation of sustainable economic to Amazon region. The biggest success actions were on the first and second axes, with highlights for surveillance, showing conservation effects between 4 and 9.9 ha to command and control actions (Börner et al., 2015). Returning to our analogy of Red Queen's race, the PPCDAM first axis is linked with the changes related to the deforestation growth, although these actions are responsive and can, in maximum, "keep us in the same place", or in the other words, the continuum loss of natural vegetation in varying speeds. The third axis, the building of a sustainable economy, is the rupture of this vicious circle that the Red Queen of the international market pegged us.

However, a low execution supporting sustainable economic activities shows that the third axis plan did not enhance the sustainable economy in the region. This may suggest that the low deforestation rates are circumstantial, which may not extinguish the possibility of new peaks of deforestation rates (IPEA, 2011).

The sustainable economy's success is related to economic viability of the practices not related to deforestation. Since deforestation is more profitable than sustainable activities, it is unlikely to succeed on the zero illegal deforestation goal. Furthermore, the deforestation predictability is related to economic changes, on a local or global scale, while a more sustainable system is not available.

Example of the system's fragility is the rise of new markets for the Brazilian meat like Russia and China. Russia started to purchase more Brazilian meat, after the embargo from EUA and EU in July 2014, allowing a 200% increase in Brazilian exporters slaughterhouses (from 30 to 90 slaughterhouses) (Rosselkhoznadzor, 2014). From August to December 2014, the Amazon State cow's meat exportation to Russia increased more than 35%, if compared to the same period of 2013 (MDIC, 2015). Livestock is one of main vectors of deforestation in Amazon (Souza et al., 2013; Margulis, 2003), so as to become symptomatic that, in the same period of 2014, the deforestation increased between 139% (INPE, 2014) and 323% (IMAZON, 2014), if compared with the same period of 2013. It is important to highlight that besides Russia and USA as new buyers of the Brazilian meat, a potential consumer is available. Since China broke its sanitary barriers during BRIC's meeting in November 2014, a new big market is available to be conquered by the

Brazilian industry meat. Although current policies, even parts of PPCDAM, aim to prevent deforestation after an announcement of new markets availability for Brazilian meat, it seems to show that there are flaws and gaps to be resolved in the application of these policies and the necessity of an economy more sustainable to region.

The rise of new consumers markets to Brazilian meat is not the only economic challenge for the maintenance of low deforestation rates. The depreciation of the Brazilian currency (real), related to the US Dollar, in the last year, has been a new threat for deforestation increase in Brazilian Amazon. Therefore, this plot is a continuous menace as long as Brazilian landowners have their costs in Reais and their possible profits in US Dollars, given the internationalization of Amazon economy (Fearnside, 2015).

The necessity of conversion to a more sustainable economy in Amazon region occurs also by reasons that had origin in actions of other most successful thematic axes of plan; as for example, the behavior change of deforester after started the DETER monitoring. After DETER system the deforestation areas became smaller and powdered, due to system's limitation of detecting areas above 25 ha (Rosa et al., 2012). This requires higher costs of command and control actions with uncertainty for the increase of efficiency (IPEA, 2011). Again, this change behavior can be seen by Red Queen's race perspective. However, in this case, it is the deforester that try to run, reacting to a new technology used by government, to keep deforesting.

Other collateral effect from command and control actions is the migration of natural vegetation loss from Amazon to Cerrado (Morton et al., 2006; Gibbs et al., 2015). While in Amazon, the conversion of natural vegetation areas in soybean fields is decreasing (30–1% between 2006 and 2013), in Cerrado, the loss of natural vegetation areas increases constantly (Gibbs et al., 2015).

The execution of PPCDAM helps to consolidate the Brazil as environmental global leader. This leadership is a comfortable situation for a country with 200 million inhabitants and with GDP rates until 7% in the last years. However, with new available markets to Brazilian meat, the policies against deforestation must be rethought, improved or even changed to accomplish ambitious goals, as compromised by Brazil.

Conflicts of interest

The authors declare no conflicts of interest.

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